WOOD CHARACTERISTICS:
A Guide for the Cabinet and Furniture Industries
# Table of Contents

## INTRODUCTION

## COLOR AND GRAIN CHARACTERISTICS
- Alder
- Birch
- Cherry
- Eastern White Pine
- Eucalyptus
- Hard Maple
- Hickory
- Red Oak
- Soft Maple
- White Oak

## EFFECTS OF GROWTH RINGS
- Growth Ring Orientation
- Growth Ring Size

## NATURAL CHARACTERISTICS
- Burl Grain
- Tiger Stripe
- Bird’s Eye
- Knots
- Ray Flecking

## THE EFFECTS OF MINERALS
- Mineral Streak
- Mineral Stain

## STAINS

## DRYING DEFECTS

## GLOSSARY

## TECHNICAL DATA

## BIBLIOGRAPHY
Wood materials used in cabinets and furniture are products of nature and include numerous color hues, grain patterns and other natural characteristics. As a manufacturer of wood components, Woodcraft Industries believes there is a crucial need to educate our company, customers, and consumers in regard to naturally occurring wood characteristics.

As a renewable natural resource, the harvest of mature trees provides wood products for our homes and offices while providing space for the establishment of new forests. The total growth of hardwood trees exceeds the harvest. In fact, our nation’s inventory of growing hardwood is increasing; and has been for the past forty years. This growth in excess of harvest does not release us from the responsibility of wise and effective utilization of our hardwood resource. Approximately fifty percent of the surface area of the lumber introduced into our manufacturing plants is not currently used for furniture or cabinets because it contains characteristics such as burls, knots, stains, and grain distortions that customers and consumers find unacceptable.

Responsible marketing and manufacturing of natural hardwood characteristics can extend the hardwood supply while generating economic and environmental benefits for current and future generations.

By working together, we hope to develop an industry-wide appreciation and understanding of the color, grain, and natural characteristics of wood.
Color and grain patterns are the primary factors influencing the appearance of wood. Other characteristics such as stains, burls, and insect damage also have an effect. All are variable, not only in different commercial groups of wood, but within a given species, log, or board. This infinite natural variety is one of wood’s greatest selling points.

**Color Variation Influences**
The natural causes of color variation within a species are influenced by many factors. Soil types, minerals, water levels, available sunlight, temperature, and genetic composition all contribute to color variation.

Hardwood trees regenerate from seeds, root sprouts, and stump sprouts. Trees originating from seeds contain genetic variables from two parent trees, while sprouts from roots and stumps will be genetically identical to the parent tree. Because of these variables, trees of the same species from one area may be quite different from trees of the same species in other areas.

The actual color variations are caused by natural chemical extractives found in the cell walls of wood. The hues produced through these deposits cover a wide range and are traceable to four spectral colors: red, orange, yellow and violet. Other natural influences, such as fungi, may also contribute to some color variations.

The range of color variation in a commercial lumber group may be increased by the mixing of species, such as northern red oak and pin oak within the red oak commercial group. Logs of these species are normally not separated by sawmills. This mixed lumber will increase the color variation in products manufactured from this material.

**Grain Variation Influences**
Grain variation, like color variation, is influenced by many factors. They include, but are not limited to, tree size, growth rate, climate changes, site conditions, genetics and bird, insect and fire damage.
Alder

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COLOR VARIATION</th>
<th>WOOD PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common</td>
<td>Pale yellow to reddish brown</td>
<td>Straight grained, fine textured</td>
</tr>
<tr>
<td><em>(Alnus glutinosa)</em></td>
<td></td>
<td>Moderately heavy and soft</td>
</tr>
<tr>
<td>Red alder</td>
<td></td>
<td>Low bending strength</td>
</tr>
<tr>
<td><em>(Alnus rubra)</em></td>
<td></td>
<td>Low shock resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low decay resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Susceptible to color shift</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End grain porosity may require</td>
</tr>
<tr>
<td></td>
<td></td>
<td>additional finishing steps</td>
</tr>
</tbody>
</table>

GROWTH RANGE
Birch

**SPECIES**
- Paper birch (*Betula papyrifera*)
- Yellow birch (*Betula alleghaniensis*)

**COLOR VARIATION**
- Creamy white to medium brown

**WOOD PROPERTIES**
- Light, hard, strong
- Very high shock resistance
- Very fine, uniform grain
- Moderately large shrinkage during seasoning

**GROWTH RANGE**
## Cherry

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COLOR VARIATION</th>
<th>WOOD PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black cherry</td>
<td>Nearly white to light red to dark reddish brown</td>
<td>Moderately hard and heavy, strong, stiff</td>
</tr>
<tr>
<td>(<em>Prunus serotina</em>)</td>
<td></td>
<td>High shock resistance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fine to medium, uniform grain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderately large shrinkage during seasoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Susceptible to color shift</td>
</tr>
<tr>
<td></td>
<td></td>
<td>End grain porosity may require additional finishing steps</td>
</tr>
</tbody>
</table>

### Growth Range

![Map of Cherry Growth Range](image)

---

8 Wood Characteristics
## Eastern White Pine

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COLOR VARIATION</th>
<th>WOOD PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern white pine</td>
<td>Off white to light brown</td>
<td>Light in weight</td>
</tr>
<tr>
<td>(<em>Pinus strobus</em>)</td>
<td></td>
<td>Moderately soft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderately low in strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Uniform in texture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Small shrinkage during seasoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pitch can be solidified in drying process</td>
</tr>
</tbody>
</table>

### Growth Range

![Growth Range Map](map_url)
Eucalyptus

**SPECIES**
Hybrid
*(Eucalyptus spp.)*

**COLOR VARIATION**
Red to brown

**WOOD PROPERTIES**
Heavy, hard, stiff
High shock resistance
Fine to medium grain
# Hard Maple

## Species

<table>
<thead>
<tr>
<th>Species</th>
<th>Color Variation</th>
<th>Wood Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar maple</td>
<td>Nearly white to slightly reddish brown</td>
<td>Heavy, strong, stiff</td>
</tr>
<tr>
<td>(Acer saccharum)</td>
<td></td>
<td>High shock resistance</td>
</tr>
<tr>
<td>Black maple</td>
<td></td>
<td>Fine, uniform grain</td>
</tr>
<tr>
<td>(Acer nigrum)</td>
<td></td>
<td>Large shrinkage during seasoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Density and fiber direction adversely affects stain absorption</td>
</tr>
</tbody>
</table>

## Growth Range

- [Growth Range Image](#)

## Wood Properties

- Heavy, strong, stiff
- High shock resistance
- Fine, uniform grain
- Large shrinkage during seasoning
- Density and fiber direction adversely affects stain absorption
# Hickory

## SPECIES
- Bitternut hickory (*Carya cordiformis*)
- Pecan (*Carya illinoensis*)
- Shagbark hickory (*Carya ovata*)

## COLOR VARIATION
- Nearly white to dark brown

## WOOD PROPERTIES
- Very heavy, very hard, very strong, very stiff
- Extremely high shock resistance
- Fine, uniform grain
- Very large shrinkage during seasoning
- Requires special tools to process

## GROWTH RANGE

![Hickory Growth Range Map](image)

---

12  Wood Characteristics
Red Oak

**SPECIES**

Northern red oak  
*(Quercus rubra)*

Pin oak  
*(Quercus palustris)*

Black oak  
*(Quercus velutina)*

Scarlet oak  
*(Quercus coccinea)*

Cherrybark oak  
*(Quercus falcata)*

Southern red oak  
*(Quercus falcata, var.)*

**COLOR VARIATION**

Light tan to pink, to red, to dark brown

**WOOD PROPERTIES**

Heavy, hard, stiff

High shock resistance

Medium fine, uniform grain

Large shrinkage during seasoning

**GROWTH RANGE**
Soft Maple

**SPECIES**
- Silver maple
  
  (*Acer saccharinum*)
- Red maple
  
  (*Acer rubrum*)

**COLOR VARIATION**
- Nearly white to light gray

**WOOD PROPERTIES**
- Moderately heavy, strong, stiff
- Medium shock resistance
- Fine, uniform grain
- Moderate shrinkage during seasoning

**GROWTH RANGE**

[Map of growth range showing the distribution of Soft Maple across the United States.]
# White Oak

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COLOR VARIATION</th>
<th>WOOD PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>White oak (Quercus alba)</td>
<td>Creamy white to medium brown</td>
<td>Heavy, very hard, strong</td>
</tr>
<tr>
<td>Bur oak (Quercus macrocarpa)</td>
<td></td>
<td>High shock resistance</td>
</tr>
<tr>
<td>Swamp white oak (Quercus bicolor)</td>
<td></td>
<td>Medium fine, uniform grain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large shrinkage during seasoning</td>
</tr>
</tbody>
</table>

**GROWTH RANGE**

![Map showing growth range of White Oak species](image)

[www.woodcraftind.com](http://www.woodcraftind.com)

15
Growth ring orientation is determined by how the lumber is cut from the log. Lumber grain is categorized in one of three ways as seen below.

In commercial practice, quartersawn lumber has growth rings at angles of 45 to 90 degrees to the wide surface. Flatsawn lumber has growth rings at 0 to 45 degrees and riftsawn lumber has growth rings at 30 to 60 degrees to the wide surface. All three orientations can occur in one board because of curves or bends in the log from which the board is sawn.
Growth Ring Size

The amount of annual growth influences the “look” of sawn lumber. Growth rings of a tree are distinctive because of the light and dark colors. The lighter portion is usually grown in the spring and is called “summerwood.” The size of the growth rings varies from species to species and even tree to tree depending on many factors including genetics and growing conditions. These two examples have approximately the same growth ring orientation yet look very different.
Burl Grain

Burl grain is common in most species and is also known as curly grain, burly grain, fiddleback or figure wood. Various causes of burl grain include knot location, damage to the bark cambium layer, and tree genetics. Burl grain is often a desired characteristic for specialty products, but can be difficult to machine.
Tiger Stripe

The unique tiger stripe grain pattern (also called zebra-wood) is common in red and white oak and both hard and soft maple, as well as other species. Tiger stripe is most often found along with burl grain, which can be difficult to machine or sand. Wood with this grain characteristic is often quite dense compared to the average density of the species.

Red Oak

White Oak

Hard Maple

Soft Maple
Bird’s Eye

Bird’s eye, as seen in this hard maple example, is a small area in the wood where fibers are contorted to form circular figures that resemble birds’ eyes on the surface of the board. It is common in hard maple and rare in other species.

Knots

Knots vary in size, shape, structure, and color. Because of this, it may be the most difficult characteristic of wood to classify.

Closed Knot
A closed knot has a flat face with no openings in the lumber surface.

Open Knot
An open knot may occur in the form of a very small pin-sized hole to a large gaping hole in the lumber surface.

Red Ring Knot
This example shows a red ringed knot in eastern white pine. These knots are sound or tight and do not usually fall out during machining.
**Black Ring Knot**
This photo shows a black ring knot in eastern white pine. These knots may loosen during the machining process.

**Sound Knot**
A sound knot, also known as a tight knot, is completely solid with no portion of the knot movable. It is as hard as the surrounding wood and shows no sign of decay.

**Unsound Knot**
An unsound knot, also known as a loose knot, has a portion that will move readily.

**Pin Knot**
A pin knot is a small, sound, and tight knot.

**Knot Cluster**
A knot cluster is a grouping of usually small knots.
Ray Flecking

Ray flecking is visible in hardwood species that are quartersawn and have rays. Rays are strips of cells that extend radially within a tree. These rays primarily store food and transport it horizontally. Red oak and white oak are most noted for this characteristic. The examples show ray flecking with variations in ray widths.

Wide Rays in Red Oak

Narrow Rays in Red Oak

Wide Rays in White Oak

Narrow Rays in White Oak
**Bark**
This example shows a piece of lumber with bark on its outer edge. The outer portion of the bark is the nonliving portion, which protects the inner living portion from external damage.

**Bark Pocket**
This hard maple example shows a typical bark pocket with a bark-filled hole on the board surface.

**Vining**
This hickory example shows a maroon color stain with a uniform cross hatch appearance. This characteristic appears to be seasonal and may develop in the log after harvesting.

**Incipient Rot**
Rot (also known as decay) is the decomposition of a substance by fungi. This photo of white oak shows incipient rot, which is rot in the early stages, and is identified by a slight discoloration or bleaching of the wood. Rot-causing fungi grow only in wood with a moisture content above approximately 30 percent and cease growing when the wood is dried below 30 percent.

**Advanced Rot**
Advanced rot causes the wood to become soft and punky. Note the black “zone lines” in this birch example, which occasionally appear in and around the bleached areas. As the rot progresses to this stage, the wood loses much of its strength.
Bird Peck
Bird peck is shown here in hickory, but is also common in maple. Woodpeckers produce a small hole, which is the starting point for brown to blackish mineral streak.

Worm Track
Worm track (also referred to as pith fleck) is shown here in maple. Worm track appears as small, narrow, yellowish to brownish streaks 1/32” to 1/16” wide and 1/8” to 2” long. Worm track is caused by cambium miners feeding beneath the bark from the branches to the roots. Their tiny burrows are filled in by new cell growth and become embedded in the wood as the tree continues to grow.

Pitch Pocket
Pitch pocket (sometimes referred to as gum spot) is common in cherry. It is caused mainly by peach bark beetles and cambium miners. The feeding insects cause injury to the living portion of the bark, leading to the formation of gum spots in the wood as the tree continues to grow.
**Carpenter Ant Damage**

The heartwood lumber shown here has typical damage caused by carpenter ant infestation. Often the damaged wood is darkened by decay and staining. Carpenter ants can infest both hardwoods and softwoods.

**Worm Hole**

The damage in this red oak example was caused by oak timberworms. These worms cause most worm hole damage seen in red and white oak. The worm tunnel size ranges from 1/64” to 3/16”. Wood moisture content must be above 30 percent for timberworms to continue activity.

**Grub Hole**

Red oak bores cause damage as seen in this example. Red oak borer tunnels are flattened ovals 1/2” to 3/4” in diameter. These insects require a two-year cycle to complete one generation.
Mineral Streak

A darkened or discolored wood area, caused by minerals which the tree extracts from the soil, can be either mineral streak or mineral stain. Mineral streak appears as a blackish-blue, well-defined streak running parallel with the grain. It is commonly found in maple and birch, and occasionally in oak and cherry. The streak can be measured easily by its length and width.
Mineral Stain

Commonly found in oak, mineral stain appears as a dark, blotchy area with undefined boundaries. It can turn an entire board darker in color.
STAINS

**Water Spot**
Water spot or water stain is a common condition in hickory. The exact origin of these spots is unknown, however this example is either fungal growth or enzymatic stain developed in the sawn log or green lumber.

**Heartwood Stain**
This hard maple sample shows what is commonly referred to as heartwood stain. This characteristic can be caused by typical staining fungi or a buildup of natural extractives, such as sugars, in many species.

**Bacterial Infection**
Typical bacterial infection (sometimes referred to as wetwood stain), shown here in red oak, can have colors ranging from gray to brown. It can occasionally be identified in the predryer or kiln by a sweet, fermented, sometimes foul-smelling odor (similar to corn silage). Due to the unusually high moisture content, wetwood stain may shrink excessively in the kiln, causing surface checks, end checks, honeycomb, and shake.

**Shake**
Shake (sometimes called ring shake or wind shake) is pictured here in red oak. The flatsawn portion shows typical shake and the end grain portion shows the ring failure. Shake can be caused by bacteria that infect the living trees. The bacteria, which has a vinegar or rancid smell before drying, weakens the area between the growth rings and may cause shake in apparently sound lumber.
Sap Stain

These two examples show bluish and grayish sap stain in red oak. These stains have a wide color range including blue, gray, brown, orange, purple and red depending on which fungus and wood species are involved. Sap stain usually appears in a pie-shaped area within sapwood.

Iron Stain

This red oak board shows a typical iron stain or watermark left from a steel band used to band lumber for shipment. This discoloration affects areas that have come in direct contact with iron (such as bands, forks of a lift, or chains). This stain type usually affects only the surface and is easily removed during the planing operation.

Water Stain

Water stain can commonly look like this dirty gray red oak example. These stains range in color from gray to brown to black, depending on which fungus and wood species are involved. This type of stain can occur in green lumber before drying or in high moisture dried lumber.
**DRYING DEFECTS**

---

**Brown Stain**
This photo shows brown stain also known as kiln burn in eastern white pine. This stain occurs during the kiln drying process.

**Sticker Stain**
Sticker stain or sticker shadow can occur in most whitewoods. It is shown here in soft maple. This stain is of a chemical nature and is caused by lumber coming in contact with stickers used in the drying process. It can be difficult to control during the drying process in certain weather conditions. The stain is often quite deep and impossible to remove by surfacing the lumber.

**Air Check**
This example shows a piece of red oak with air check or surface check. This type of checking occurs in the early drying stages if too much moisture is removed from the outer portion of the lumber before the inner portion has had a chance to lose moisture and shrink.

**Honeycomb**
Although not a natural characteristic, honeycomb is common in the industry. This example shows end grain and lumber ripped in half to expose the severe interior honeycomb. This occurs when kiln temperatures are raised before the lumber core moisture has been lowered sufficiently.
Splitting or Cracking
Splitting or cracking can occur in any species. Shown here in red oak, it can be minimized by proper end coating of the logs or lumber before they have an opportunity to dry.

Caramelized Maple
Occurring in dry kilns for hardwood and hot ponds for veneer; maple dried at temperatures too high results in a caramelized appearance.
**Glossary**

**Air Check (p. 30)**
A lengthwise separation of the wood extending across the annual growth rings. It is a result of stresses developed in wood during drying.

**Bacterial Infection (p. 28)**
Lumber (generally red oak) infected with an anaerobic bacteria. This lumber will emit a sour odor and will be susceptible to honeycomb or ring shake during the drying process.

**Bark Pocket (p. 23)**
A bark-filled hole on the board surface.

**Bird Peck (p. 24)**
Woodpeckers produce a small hole, which is the starting point for brown to blackish mineral streak. Hickory and maple are most commonly affected.

**Bird’s Eye (p. 20)**
Small areas in wood where fibers are contorted to form small circular figures that resemble birds’ eyes. Bird’s eye is common in hard maple and rare in other species.

**Black Ring Knot (p. 21)**
These knots are sound or tight and do not usually fall out during machining.

**Brown Rot**
Any decay in wood that attacks only cellulose and carbohydrates rather than lignin.

**Brown Stain (p. 30)**
Brown stain is a discoloration of wood that can occur during kiln drying as a result of a change in the color of substances normally present in green softwoods.

**Burl Grain (p. 18)**
A swirl or twist in the wood grain that occurs near a knot but does not contain a knot over 1/8” in diameter.

**Cambium**
The thin layer separating the bark and wood that contains the living reproductive cells. Through cell division, these cells create additional bark and wood cells.

**Caramelized Maple (p. 31)**
Maple wood that has been heated to a high temperature causing its sugars to turn a brownish color.

**Carpenter Ant (p. 25)**
Insect that often infests trees and lumber.

**Closed Knot (p. 20)**
Closed knots have a flat face with no openings in the lumber surface.

**Color Shift**
The change in appearance most commonly seen in cherry caused by exposure to light.

**Flatsawn (p. 16)**
Lumber that has grown rings at angles of 0 to 45 degrees to the wide surface of the lumber.

**Growth Ring (p. 16, 17)**
The annual production of wood by a tree, consisting of springwood and summerwood.

**Grub Hole (p. 25)**
An opening in a tree or lumber caused by an insect larva.

**Heartwood**
The central core of wood in a tree that no longer conducts sap or has living tissues. In some species, the build-up of extractives in the heartwood darkens the wood color in this area.

**Heartwood Stain (p. 28)**
The brownish to blackish color in hard maple that is commonly referred to as stain, although it is not a true stain. Rather, it’s a build-up of extractives causing the heartwood to be much darker in some trees.

**Honeycomb (p. 30)**
Checks, often not visible at the surface, which occur in the interior of a piece of wood along the wood rays. Honeycomb is caused by stress built up during drying.

**Iron Stain (p. 29)**
A bluish streak on lumber caused by the chemical reaction between iron and wood.

**Knot (p. 20, 21)**
The wood fiber associated with a tree limb or branch.

**Knot Cluster (p. 21)**
Grouping of knots.

**Mineral Stain (p. 27)**
Darkened or discolored wood areas caused by minerals the tree extracts from the soil. Mineral stain appears as dark, blotchy areas with undefined boundaries that can turn an entire board darker in color.

**Mineral Streak (p. 26)**
Darkened or discolored wood areas caused by minerals which the tree extracts from the soil. Mineral streaks appear as blackish-blue, well-defined streaks running parallel with the grain (commonly found in maple and birch, sometimes in oak and cherry). This type of streak can be measured easily by its length and width.

**Open Knot (p. 20)**
Knots with open areas on the surface of the lumber.

**Paint Grade**
A lumber grade used primarily for painting. This grade varies from customer to customer and usually includes all sound wood.

**Pin Knot (p. 21)**
Knots that are small and tight.

**Pitch Pocket (p. 24)**
Openings that run parallel to the growth rings containing resin. Cherry is the most common hardwood species with this characteristic.
**Quartersawn (p.16)**
Lumber that has growth rings at angles of 45 to 90 degrees to the wide surface of the lumber.

**Ray (p.22)**
Stripes of cells extending radially within a tree and varying in height from a few cells in some species to four or more inches in oak. The rays serve primarily to store food and transport it horizontally in the tree. In quartersawn oak, the rays form a conspicuous figure, sometimes referred to as ray flecks.

**Red Ring Knot (p.20)**
These knots are sound or tight and usually will not fall out during machining.

**Riftsawn (p.16)**
Lumber that has growth rings at angles of 30 to 60 degrees to the wide surface of the lumber.

**Rot (p.23)**
Rot (also known as decay) is the decomposition of a substance by fungi. Incipient rot is rot in its early stages and usually noticeable only by slight wood discoloration or bleaching of the wood. Advanced decay causes the wood to become soft and puny.

**Sap Stain (p.29)**
Bluish-black, gray or brown wood discoloration caused by fungi. The discoloration can also be orange, purplish or red depending on the fungus and wood species involved.

**Sapwood**
The wood in the tree that conducts water up the tree stem and may contain some living cells. Sapwood may be lighter in color than heartwood due to the lack of extractives.

**Shake (p.28)**
A separation along the grain, the greater part of which occurs between the annual growth rings.

**Sound Knot (p.21)**
A knot that is solid across its face, as hard as the surrounding wood and shows no indication of decay.

**Stain (p.28, 29)**
Areas of discoloration that alter wood properties. They are caused by minerals (mineral stain), fungus (sap stain), chemical reactions in the wood (sticker stain), water (water stain), or bacteria (wetwood stain).

**Sticker Stain (p.30)**
Sticker stain or sticker shadow are cross-grain discolorations roughly 1 1/4" or 3 1/2" wide (the size of stickers and bunkers) caused by a chemical reaction in a board at the point where the sticker or bunker was placed during the drying process (commonly seen on maple).

**Tiger Stripe (p.19)**
A distorted grain pattern that in certain light resembles the stripes of a tiger.

**Tight Knot**
A knot so fixed by growth or position in a sawn board that it firmly retains its place.

**Unsound Knot (p.21)**
A knot with a portion that is readily movable and may also include areas of decay.

**Vining (p.23)**
Color stain which appears in a uniform cross hatch appearance. This characteristic appears to be seasonal and may be caused in the log form after harvesting.

**Water Stain (p.29)**
Moderately discolored areas that are dirty mustard yellow, bleached brown or dull gray. The wood looks dull, dead, rough, spongy and/or weathered.

**Wetwood Stain**
Appears as water-soaked gray to brown discoloration within the heartwood. It can be identified in the predryers or kilns by a sweet, fermented, sometimes foul-smelling odor. The water-soaked appearance results from excessive moisture produced by bacteria, sometimes twice the amount of the surrounding normal wood. Due to the high moisture content, areas of wood with wetwood stain shrink excessively in the kiln causing surface checks, end checks and/or honeycomb depending on the stain location in the board.

**White Rot**
Any decay in wood that attacks both cellulose and lignin. Black “zone lines” sometimes appear in and around the bleached areas. In later stages of rot the wood will become soft, fibrous and bleached, finally losing strength.

**Worm Hole (p.25)**
Voids in the wood caused by the burrowing action of certain wood-infesting worms.

- **Pin worm hole:** not over 1/16” in diameter.
- **Shot worm hole:** over 1/16” but not more than 1/4” in diameter.
- **Grub hole:** 1/4” and larger.

**Worm Track (p.24)**
Sometimes referred to as pitch fleck in maple, these are small, narrow, yellowish to brownish streaks 1/32” to 1/16” wide and 1/8” to 2” long. Worm tracks are caused by the maple cambium miner feeding beneath the bark from the branches to the roots. Their tiny burrows are filled in by new cell growth and become embedded in the wood as the tree continues to grow.
## TECHNICAL DATA

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>DENSITY (LBS/FT³)</th>
<th>DIMENSION CHANGE RADIAL</th>
<th>COEFFICIENT TANGENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alder</td>
<td>26.0</td>
<td>0.00151</td>
<td>0.00256</td>
</tr>
<tr>
<td>Birch</td>
<td>35.7</td>
<td>0.00219</td>
<td>0.00304</td>
</tr>
<tr>
<td>Cherry</td>
<td>35.0</td>
<td>0.00126</td>
<td>0.00248</td>
</tr>
<tr>
<td>Eastern White Pine</td>
<td>26.5</td>
<td>0.00071</td>
<td>0.00212</td>
</tr>
<tr>
<td>Eucalyptus</td>
<td>40.0</td>
<td>0.00154</td>
<td>0.00272</td>
</tr>
<tr>
<td>Hard Maple</td>
<td>42.5</td>
<td>0.00165</td>
<td>0.00353</td>
</tr>
<tr>
<td>Hickory</td>
<td>50.5</td>
<td>0.00259</td>
<td>0.00411</td>
</tr>
<tr>
<td>Red Oak</td>
<td>42.5</td>
<td>0.00158</td>
<td>0.00369</td>
</tr>
<tr>
<td>Soft Maple</td>
<td>36.4</td>
<td>0.00137</td>
<td>0.00289</td>
</tr>
<tr>
<td>White Oak</td>
<td>45.8</td>
<td>0.00180</td>
<td>0.00365</td>
</tr>
</tbody>
</table>

Dimension change coefficient is the percent change per inch for every 1% change in moisture content.

## BIBLIOGRAPHY


